The Task Of Steering The Vehicles, Taking Into Calculate The Cost Of Transportation With The Load

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Abstract: : In this article, a road is constructed to solve the problem of delivering goods from the factory to a group of consumers by a single-road transport vehicle at the lowest cost. In this case, the cost of transportation is a function of vehicle loading and road quality. A matching mathematical model is built, in the case of a linear dependence of the travel cost by the amount of material transported, a linear integer model is obtained. In order to deliver goods at the lowest cost and according to the existing data, an algorithm was proposed to solve this problem and all arithmetic experiments were performed.

***Keywords**:* vehicle steering, transportation costs.

Introduction

A systematic study of optimization problems in transport logistics (Vehicle Routing Problem) . Over the course of the next century, a multitude of problems of this type have been posed, both point and heuristic methods of solution have been developed. A particular case of such problems is that of a traveling salesman. The classification of the optimization tasks of the transport logistics is given.
The problem considered in this work is intertwined with CVRP (Capacitated VRP(Vehicle Routing Problem)), these problems take into account restrictions on the capacity of the vehicle . In most cases, when setting the task of communication, the cost of transportation is a function that depends only on the distance between the countries.
when setting the problem of communication, it is taken into account a number of additional factors that are important for practice, some of which are discussed in this article[1].
In practice, the cost of transportation depends not only on the length of the paths, between the consumers. Companies involved in the transportation of loads between remote consumers, when calculating the cost of transportation, should also take into account the conditions of loading and loading of the vehicle.
the classification of the problem of repairing [2], depending on the ratio of the large sugary load q and the load capacity Q of the vehicle, is proposed. Occasionally $Q >= q$ corresponds to the traditional traveling salesman task, and for the case $Q < q$, the term "transportation task" is used. In the second case, the load is given more for one flight, that is, it takes a network of ports coming from the single sender. Obviously, with a practical point of view, the task of transportation is of great value as it is more appropriate to the real conditions of transportation.
The work provides an approach to the solution of the problem and transportation with the crossing of ports[3] , where fuel consumption is chosen as the target function, depending on the factor:

- standard fuel consumption;
- passing the vehicle;
- correcting the coefficient to the norm;
- rates of fuel consumption for the vehicle run-through in the loaded state without load;
- the base rate of fuel consumption for the vehicle breakdown in the loaded state;
- norms of fuel consumption for additional fuel mass of the process or semi-control;
- own mass of the principle or of the sequence;
- norms of fuel consumption for transport work;
- the volume of transport work;
- weight of the load;
- passing the vehicle with a freeze.

The problem being considered is NP-hard, due to the fact that the exact methods of the problem are only used in small sizes of the problem, and the actual work is to be done.

Clarify the problem:

The load should be supplied from the point of production by consumers on a cruise line with a transport vehicle, the capacity of which is needed ( ) when q_i is the demand in the load at the i - point of consumption; n - is the number of points of consumption. For consistency, consider the item of production as z $Q \geqslant \sum_{i=1}^{n} q_i$,

The paths between the points and are characterized by two indicators: the distance l_{ij} (i, ..., n) and the complexity coefficient of the path k_{ij} between the points i, j. The distance l_{ij} may depend on the direction of movement (for example: there are roads with one-sided movement), the coefficient of complexity *kij* depends on the fuel consumption, and its value also depends on the power[4].

In transportation, one vehicle is involved with a given load capacity Q and a fuel consumption function $f(q)$ per unit of a path of a standard quality.

The function of fuel consumption, depending on the mass of the transferred load, is increasing and, as a rule, is included in the entire range of the definition of the function [0; Q].

Introduce the buoy variables X_{ij} $(i, j = 0, \ldots, n)$, equal to 1 then and only then, when following the i-th point on the vehicle's route, the j-th point, $i, j = 0, \ldots, n$. It is necessary to find buoy variables X_{ij} such that:

$$\sum_{i=0}^{n} X_{ij} = 1, j = \overline{0, n}; \qquad (1)$$

$$\sum_{j=0}^{n} X_{ij} = 1, i = \overline{0, n}; \qquad (2)$$

$$X_{00} = 0. \qquad (3)$$

Limitation (1) indicates that the vehicle arrives at each delivery point at least one time; Limit (2) indicates that from each point of delivery of the vehicle leaves one time. Limitation (3) means that the vehicle is leaving the zero point. in some other. For other points of use, this item will be based on the following limitations. Introduce the number of variables v_i ($i = 1, \ldots, n$) such that:

$$1 \leqslant v_i \leqslant n; \qquad (4)$$

$$(v_i - v_j) + nX_{ij} \leqslant n - 1. \qquad (5)$$

Permanent v_i have the meaning of consumer numbers in order of walking in a chain containing all items except the base. Conditions (4) and (5) imply the absence of arguments.

We introduce boolean variables Z_{is} equal to 1 then and only then when $v_s > v_i$ ($i, s = 1, \ldots, n$).

Limitations:

$$\sum_{i=0}^{n} \sum_{s=0}^{n} Z_{is} = n(n+1)/2; \qquad (6)$$

$$nZ_{is} \geqslant v_s - v_i. \qquad (7)$$

Condition (7) ensures the fulfillment of the equality $Z_{is} = 1$ for $v_s > v_i$. Note that in order to ensure the equality $Z_{is} = 0$ for $v_s <= v_i$, by intent, the value of v_s is the value of the value of v_i, the smallest v_s is equal to v_s - 1. Thus, the required property is ensured equality.

$$\sum_{i=1}^{n} Z_{is} = v_s - 1. \qquad (8)$$

Shipping cost :

$$R(X) = \sum_{i=0}^{n} \sum_{j=0}^{n} X_{ij} f\left(\sum_{s=0}^{n} Z_{is} q_s\right) l_{ij} k_{ij}. \qquad (9)$$

It is necessary to minimize transportation costs:

$$R(X) \to \min. \qquad (10)$$

Linear integer model:
Note that the cost of transportation is a linear function of the weight of the transported load: $f(q) = aq + b$, where a and **b** are coefficients determined by empirical values. Then the target function takes the form

$$R(X) = a \sum_{s=0}^{n} \sum_{i=0}^{n} \sum_{j=0}^{n} X_{ij} Z_{is} q_s l_{ij} k_{ij} + b \sum_{i=0}^{n} \sum_{j=0}^{n} X_{ij} l_{ij} k_{ij}. \quad (11)$$

We introduce the buoy variables T_{ijs} ($i, j, s = 0, ..., n$) as follows:

Limitations: $$T_{ijs} = X_{ij} Z_{is}. \qquad (12)$$

$$T_{ijs} \geqslant X_{ij} + Z_{is} - 1, \; T_{ijs} \leqslant X_{ij}, \; T_{ijs} \leqslant Z_{is}. \qquad (13)$$

The target function takes the form

$$R(X) = a \sum_{s=0}^{n} \sum_{i=0}^{n} \sum_{j=0}^{n} T_{ijs} q_s l_{ij} k_{ij} + b \sum_{i=0}^{n} \sum_{j=0}^{n} X_{ij} l_{ij} k_{ij}. \quad (14)$$

In such a way, changed by the set problem: X_{ij} - buoys, their number is $(n + 1)^2$; Z_{is} - buoys, their number is $(n + 1)^2$, T_{ijs} - buoys, their number is $(n + 1)^3$; v_i - Evaluated, there are n. The total number of limits is of the order $O(n^2)$.

To solve problems (1) - (14), the Clark – Wright heuristic algorithm was modified [5]. The advantages of this method are its simplicity, reliability and flexibility.

Describe the main ideas of the algorithm
The Clark-Wright method refers to the theory of used iterative methods, and at each iteration an attempt is made to join two lines according to certain rules. The suggested modification of the Clark-Wright method ends in the possibility of varying the pit of the pipe connections p, as well as taking into account the dependence of the cost of transportation on the direction of the flight path.
In addition, in the Clark-Wright method, the cost of transportation is a function of vehicle loading. In the Clarke-Wright Cassian algorithm, the splicing depth p = 0 is used[6,7].

Spend it in the sky for example and splicing ikyov. From the outset, they generate n types (lines) of the form 0 - i - 0 (i = 1, 2, ..., n). For each of the following steps, all possible options for splicing of two cycles are considered, from which the option of splicing is selected that satisfies the conditions of the load, as well as the cost of living. Suppose that on some step there is a path α:

$$0 - A_1 - A_2 - A_3 - A_4 - A_5 - A_6 - 0$$

and also route β:

$$0 - B - 0$$

Where A_1, A_2, A_3, A_4, A_5, A_6 are points α (city) visited in the routes, B is some sequence of points visited in route β. Due to the requirement of the uniqueness of the visit, ports α and β do not contain the same items. The next line is:

$$0 - A_6 - A_5 - A_4 - A_3 - A_2 - A_1 - 0$$

Received by inverting the direction of the port α. When splicing the ports, the sequence of points of one port is inserted with a line between two adjacent points and of the other port, while this is analyzed and analyzed. Then the options for splicing the lines α and β on the next step of the algorithm.

Conclusion

The problem under consideration is an actual practical problem. The results obtained allow us to conclude that it is advisable to develop a modification of the Clark-Wright algorithm or to adapt another heuristic method to solve the problem of transporting loads, taking into account the load of vehicles to reduce the deviation of the obtained results from the exactly found optimum.

Reference

1- Dantzig GB, Ramser JH. □e Truck Dispatching Problem. Management Science. 1959; 6(1):80–91.
2- Ehmke, J.F. (2012) Integration of information and optimization models for routing in city logistics. Springer.
3- Bertazzi L, Savelsbergh M, Speranza MG. Inventory Rout-ing. In: Golden B, Raghavan S, Wasil E editors. the Vehicle Routing Problem: Latest Advances and New Challenges. New York: Springer Science+Business Media. 2008; 49–72.
4- Anderson, J.E. and E. van Wincoop (2004) “Trade Costs”, Journal of Economic Literature, Vol. 42, No. 3, pp. 691-751.
5- Limao N. and A.J. Venables (2001) Infrastructure, Geographical Disadvantage, Transport Costs, and Trade, The World Bank Economic Review, No 15, pp. 451-479.
6- Rietveld, P. (1994) “Spatial Economic Impacts of Infrastructure Supply”, Transportation Research Part A, Vol. 28, No. 4, pp. 329-341.
7- D. Sariklis and S. Powell, “A heuristic method for the open vehicle routing problem,” The Journal of the Operational Research Society, vol. 51, no. 5, pp. 564–573, 2000.